Small Business Innovation Research/Small Business Tech Transfer

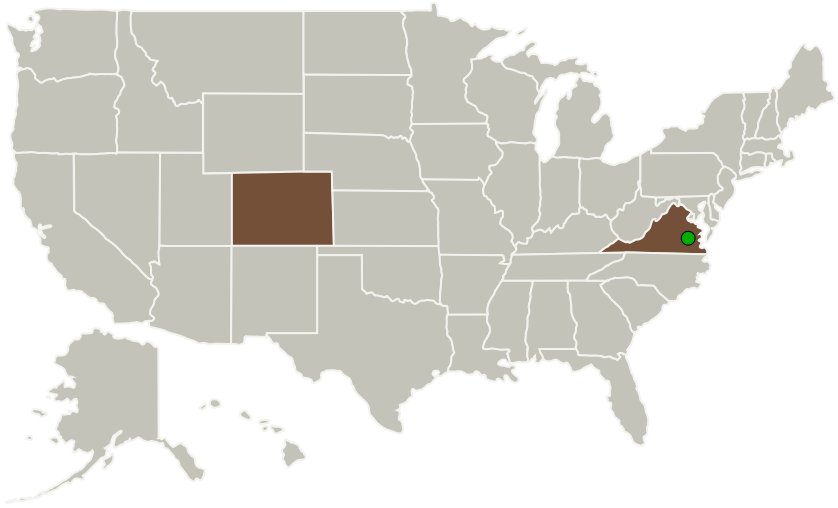
A Rapid Model Fitting Tool Suite, Phase II

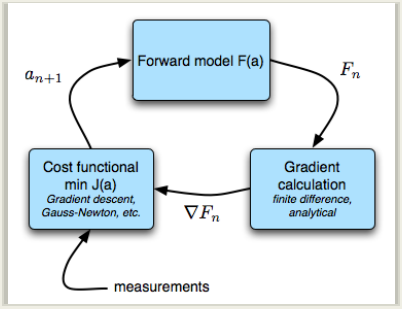
Completed Technology Project (2012 - 2014)

Project Introduction

An integral component of many NASA missions involves remote sensing of the environment, both terrestrial and celestial. This is a challenging problem, since quantities of interest typically can not be directly measured but instead must be inferred. These inferences are made by solving inverse problems, where complex forward models are inverted to estimate parameters of the model. These parameters correspond to physical properties of the environment. Because of the complexity of many forward models, inversion is usually accomplished by minimizing the difference between observations and model predictions through adjustment of model parameters. This minimization process is computationally demanding, since it requires evaluating the forward model many times and minimizing a function of many variables. In this project, we propose to develop, using low-cost high performance hardware accelerators, a fast general-purpose parameter fitting software tool suite for fitting model parameters to observed data. The tool suite will allow NASA scientists to use state of the art high performance computing resources to speed their work. In the Phase I of this project we have shown that the three key components of model fitting, namely model evaluation, gradient calculation and cost functional minimization, can be accelerated using graphical processing unit (GPU) technology. The Phase I work has laid the foundation for Phase II of the project, where the components investigated and developed will be integrated into a parameter fitting tool suite. During Phase II, we will work closely with NASA scientists from the Stratospheric Aerosol and Gas Experiment (SAGE) III mission, the Solar Dynamics Observatory (SDO) and other missions to develop further capabilities of the tool suite.

Primary U.S. Work Locations and Key Partners





A Rapid Model Fitting Tool Suite

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Organizations Performing Work	Role	Type	Location
Tech-X Corporation	Lead Organization	Industry	Boulder, Colorado
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Colorado	Virginia

Project Transitions

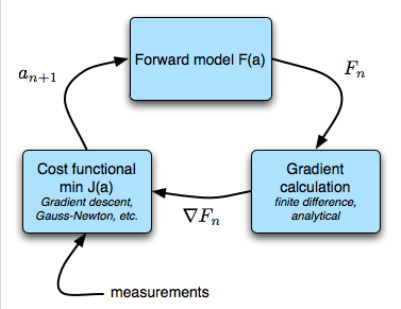
April 2012: Project Start

April 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137843)*

Images



Project Image
A Rapid Model Fitting Tool Suite *(https://techport.nasa.gov/image/131945)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Tech-X Corporation

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

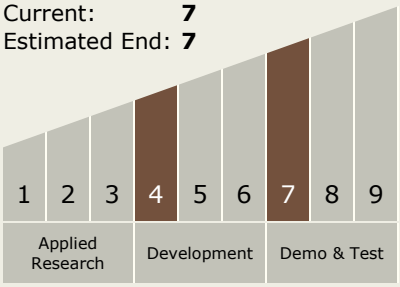
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Michael Galloy

Technology Maturity (TRL)

Start: **4**
Current: **7**
Estimated End: **7**



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Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.4 Information Processing
    - TX11.4.4 Collaborative Science and Engineering

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System